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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/660,813	09/12/2003	Hemant P. Mungekar	A8067/T51700	7055

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EXAMINER	
MCDONALD, RODNEY GLENN	
ART UNIT	**PAPER NUMBER**
1795	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/660,813	MUNGEKAR ET AL.	
	Examiner	Art Unit	
	Rodney G. McDonald	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 July 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-5, 7, 11-15; 17, 18, 20-24, 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Papasouliotis et al. (U.S. Pat. 6,846,745) in view of Bayman et al. (U.S. Pat. 6,596,654).

Regarding claim 1, Papasouliotis et al. '745 teach in Fig. 1B a process whereby a first portion of a film is deposited over the substrate from a first gaseous mixture flowed into the process chamber by chemical vapor deposition. (See Fig. 1B block 123;

Column 6 lines 42-55) Thereafter etching the first portion by flowing an etchant gas comprising a fluorinated plasma. The fluorine containing plasma can include SiF_4, SiH_2F_2 (i.e. this gas contains a halogen precursor (a fluorine precursor) and hydrogen precursor (a hydrogen precursor) similar to Applicant's concept where the hydrogen and oxygen are formed by a single compound), and NF_3 (i.e this gas contains a halogen precursor) for example. Other process gases can be included in the etchant plasma including oxygen, inert carrier gas and silicon-containing gas such as silane (i.e. a hydrogen precursor) (See Fig. 1B block 125; Column 8 lines 66-68; Column 9 lines 1-20) Thereafter a second portion of the film is deposited over the substrate from a second gaseous mixture of flowed into the process chamber by chemical vapor deposition. (See Fig. 1B block 129; Column 10 lines 21-24; Column 10 lines 50-53) The process is used for filling high aspect ratios. (See Abstract)

Regarding Claims 1 and 26 where the halogen precursor and the hydrogen precursor being flowed into the processing chamber at respective flow rates to control chemical interaction between the halogen precursor and the hydrogen precursor to provide a desired etch rate, Papasouliotis et al. '745 teach that the flow rate of the precursors can be controlled. For example the halogen precursor gas (i.e. NF_3 or SiH_2F_2) can have a flow rate of 0 up to about 500 sccm. The hydrogen precursor gas (i.e. SiH_4) can have a flow rate of 0 to 60 sccm. The oxygen precursor gas can flow at about 10 to 1000 sccm. (Column 9 lines 1-20)

Regarding claim 3, the halogen precursor comprises a fluorine precursor. (Column 8 lines 66-68; Column 9 lines 1-20)

Regarding claim 4, the fluorine precursor can be NF3. (Column 9 line 3)

Regarding claim 7, the fluorine precursor can be SiF4. (Column 9 line 2)

Regarding claims 11, 12, during the etching a high-density plasma is maintained. (Column 9 lines 24-25)

Regarding claim 13, the etchant can include an inert sputtering agent in the form of inert carrier gas. (Column 9 line 12)

Regarding claims 14, 15, the inert carrier gases are enumerated as helium, argon, and xenon. (Column 9 line 12; Column 9 lines 47-49)

Regarding claim 17, the deposition of the film is performed by maintaining a plasma. (Column 7 lines 53-65; Fig. 1B)

Regarding claims 18, the plasma is biased toward the substrate. (Column 8 lines 27-43)

Regarding claims 23, 26, Papasouliotis et al. '745 teach in Fig. 1B a process whereby a first portion of a film is deposited over the substrate from a first gaseous mixture flowed into the process chamber by chemical vapor deposition. (See Fig. 1B block 123; Column 6 lines 42-55) Thereafter etching the first portion by flowing an etchant gas comprising a fluorinated plasma. The fluorine containing plasma can include SiF_4, SiH_2F_2 (i.e. this gas contains a halogen precursor (a fluorine precursor) and hydrogen precursor (a hydrogen precursor) similar to Applicant's concept where the hydrogen and oxygen are formed by a single compound)and NF_3 for example. Other process gases can be included in the etchant plasma including oxygen, inert carrier gas and silicon-containing gas such as silane (i.e. a hydrogen precursor) (See Fig. 1B block

125; Column 8 lines 66-68; Column 9 lines 1-20) The flow rates of the gases can be controlled. (Column 9 lines 12-20) Thereafter a second portion of the film is deposited over the substrate from a second gaseous mixture of flowed into the process chamber by chemical vapor deposition. (See Fig. 1B block 129; Column 10 lines 21-24; Column 10 lines 50-53) The process is used for filling high aspect ratios. (See Abstract)

Regarding claims 23, 24, 27, the plasma can be biased toward the substrate during etching. (Column 9 lines 26-30)

The difference not yet discussed is the flow rate of the hydrogen precursor is not discussed (Claims 1, 26, 20), where the hydrogen precursor comprises H_2 is not discussed (Claims 2, 20), the substrate including silicon nitride and control of the hydrogen and NF3 is not discussed (Claims 5, 21, 22).

Regarding claims 1, 26, 20, Bayman et al. teach controlling the flow rate of a hydrogen precursor at greater than 400 sccm for controlling the sputtering rate (i.e. sputter etch rate) in order to provide higher bottom fill for BPSG. (i.e. boron phosphorous silicate glass) (Column 4 lines 40-67; Column 8 lines 24-25)

Regarding claims 2, 20, Bayman et al. teach that the hydrogen precursor can be H_2. (Column 4 lines 40-67)

Regarding claims 5, 21, 22, the substrate can include a silicon nitride layer if the gas includes NF_3. The control of the hydrogen controls the bottom fill. (Column 8 lines 27-33; Column 4 lines 40-67)

Bayman et al. recognize control of the hydrogen gas to control sputter rate. (Column 4 lines 40-67)

The motivation for utilizing the features of Bayman et al. is that it allows for bottom fill. (Column 4 lines 40-67)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Papasouliotis et al. '745 by utilizing the features of Bayman et al. because it allows bottom fill.

Claims 6 and 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Papasouliotis et al. '745 in view of Bayman et al. as applied to claims 1-5, 7, 11-15, 17, 18, 20-24, 26 and 27 above, and further in view of Jimbo et al. (U.S. Pat. 5,756,402).

The differences not yet discussed is the fluorine precursor comprises F_2 is not discussed (Claim 6), the hydrogen precursor and the oxygen precursor in a single compound is not discussed (Claim 8), the single compound being water is not discussed (Claim 9) and the single compound being hydrogen peroxide is not discussed (Claim 10).

Regarding claim 6, Jimbo et al. teach that instead of SiF_4 the fluorine precursor can be F_2. (Column 3 line 56)

Regarding claims 8-10, Jimbo et al. teach that instead of H_2 and O_2 the hydrogen precursor can be H_2O or H_2O_2. (Column 3 line 60)

The motivation for utilizing features of Jimbo et al. is that it allows for selective etching. (Column 2 lines 4-6)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized the features of Jimbo et al. because it allows for selective etching.

Claims 16, 19, 25 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Papasouliotis et al. '745 in view of Bayman et al. as applied to claims 1-5, 7, 11-15, 17, 18, 20-24, 26 and 27 above, and further in view of Papasouliotis et al. (U.S. Pat. 6,794,290).

The differences not discussed is controlling the sputter removal ratio (Claim 16), the control of the hydrogen gas to effect the etching distribution (Claims 19, 25) and the control of the flow of the second precursor gas to provided a different distribution within the processing chamber than the first precursor gas, thereby effecting a nonuniform etching distribution over the substrate (Claim 28).

Regarding claims 16, 28, Papasouliotis et al. '290 teach controlling the flow rate of argon to hydrogen to control the rate of sputtering and chemical etching. (Column 7 lines 7-20)

Regarding claim 19, 25, Papasouliotis et al. '290 teach controlling the flow rate of hydrogen in the chamber. (See Column 7 lines 7-20)

The motivation for controlling process gases and controlling process parameters is that it allows for achieving better control of etching rate. (Column 7 lines 1-2)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized the features of Papasouliotis et al. '290 because it allows for achieving better control of etching rate.

Response to Arguments

Applicant's arguments filed July 2, 2007 have been fully considered but they are not persuasive.

In response to the argument that Bayman fails to teach utilizing a hydrogen based precursor during an etching phase of a halogen based etching process, it is argued that Papasouliotis et al. teach utilizing a hydrogen based precursor during an etching process but Papasouliotis et al. teach that if silicon containing fluorine compounds are used they may contribute somewhat to the deposition of the dielectric during etching. If this is the case then one would look to Bayman for utilizing a hydrogen based precursor since Bayman suggest a hydrogen based precursor for etching when material is contributing to the deposition. (See Papasouliotis et al. and Bayman discussed above)

In response to the argument that Bayman's teaching of utilizing the flow rate of hydrogen would be appropriate for the flow rate of SiH_2F_2, it is argued that Papasouliotis et al. teach that if silicon containing fluorine compounds are used they may contribute somewhat to the deposition of the dielectric during etching. If this is the case then one would look to Bayman for utilizing a hydrogen based precursor since Bayman suggest a hydrogen based precursor for etching when material is contributing to the deposition. (See Papasouliotis et al. and Bayman discussed above)

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M-Th with every Friday off..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Rodney G. McDonald
Primary Examiner
Art Unit 1795

RM
January 2, 2008